

# PATENT ABSTRACTS OF JAPAN

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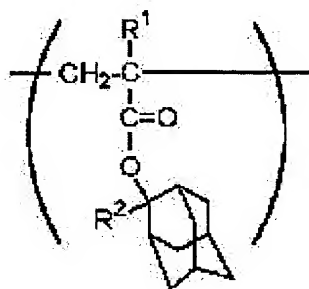
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## (54) CHEMICAL AMPLIFICATION TYPE POSITIVE RESIST COMPOSITION

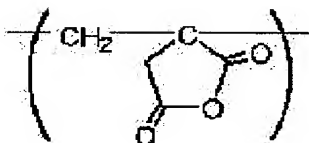
(57)Abstract:

PROBLEM TO BE SOLVED: To improve dry etching resistance, resolution and adhesiveness by combining specified two polymn. units.

SOLUTION: The resist compsn. contains a resin contg. polymn. units of formulae I and II and an acid generating agent. In the formulae I and II, R<sub>1</sub> is H or methyl, R<sub>2</sub> is 1-4C alkyl and this alkyl is advantageously linear but may be branched and is, e.g. methyl, ethyl, n-propyl, isopropyl or n-butyl. The resin can be produced by copolymerizing a 2-alkyl-2-adamantyl (meth)acrylate and maleic anhydride as essential constituent monomers. Butyrolactone residues are preferably incorporated into the resin from the viewpoint of adhesiveness. The butyrolactone residues may be substd. by alkyl.



I



II

## LEGAL STATUS

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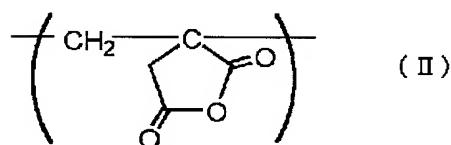
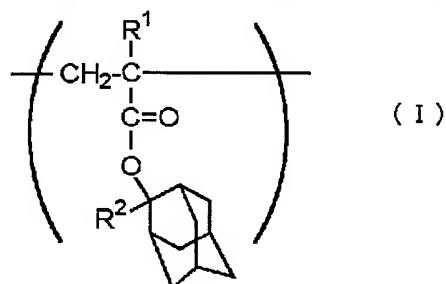
2.\*\*\* shows the word which can not be translated.

3.In the drawings, any words are not translated.

## CLAIMS

[Claim(s)]

[Claim 1] Bottom type (I) It reaches (II).

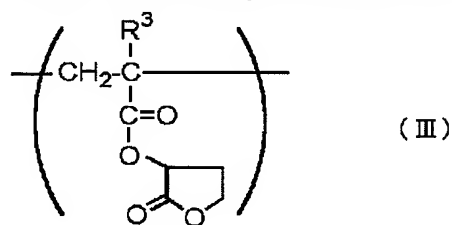


They are resin including each polymerization unit shown by (R1 expresses hydrogen or methyl among a formula, and R2 expresses the alkyl of carbon numbers 1-4), and the chemistry magnification mold positive-resist constituent characterized by containing an acid generator in a list.

[Claim 2] The constituent according to claim 1 with which this resin includes the polymerization unit

which has further the butyrolactone residue which may be permuted by alkyl.

[Claim 3] The polymerization unit which has butyrolactone residue is a bottom type (III).



It is the constituent according to claim 2 shown by (R3 expresses hydrogen or methyl among a formula).

[Claim 4] The constituent according to claim 1 to 3 which comes to dissolve this resin and this acid generator in the solvent containing 2-heptanone.

## DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the positive-resist constituent of the chemistry magnification mold used for micro processing of a semi-conductor.

[0002]

[Description of the Prior Art] The lithography process which used the resist constituent is usually adopted as micro processing of a semi-conductor, it sets to lithography, and he is Rayleigh. (Rayleigh) It is so possible that exposure wavelength is theoretically short so that it may be expressed with the formula of a diffraction limitation to raise resolution. The exposure light source for the lithography used for manufacture of a semi-conductor serves as g line with a wavelength of 436nm, i line with a wavelength of 365nm, and a KrF excimer laser with a wavelength of 248nm to short wavelength every year, and promising \*\* of the ArF excimer laser with a wavelength of 193nm is carried out as the next-generation exposure light source.

[0003] The thing short as much as possible of the time amount by which the lens used for an ArF excimer laser exposure machine is put to ArF excimer laser light since the life is short compared with the thing for the conventional exposure light sources is desirable. For that purpose, since it is necessary to raise the sensibility of a resist, the catalysis of the acid generated by exposure is used and the so-called chemistry magnification mold resist containing the resin which has the radical which \*\*\*\* with the acid is used.

[0004] In order for the resin used for the resist for ArF excimer laser exposure not to have a ring in order to secure the transmission of a resist, and to give dry etching resistance, it is known that what has an alicyclic ring instead of a ring is good. It is D.C. Hofer, Journal of Photopolymer Science and Technology, Vol.9, and No.3 (1996) 387-398 as such resin until now. Various kinds of resin which is indicated is known. However, conventionally, by well-known resin, when especially the polarity is

insufficient, there is a problem of a lifting or a cone for development peeling from the adhesive lack at the time of development.

[0005]

[Problem(s) to be Solved by the Invention] The purpose of this invention is the positive-resist constituent of the chemistry magnification mold which contained the resinous principle and the acid generator and fitted excimer laser lithography, such as ArF and KrF, and it is to offer what is excellent in especially the adhesive property to a substrate while various kinds of resist engine performance, such as sensibility and resolution, is good.

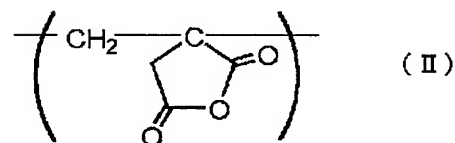
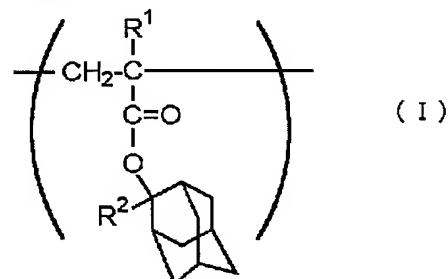
[0006] this invention persons completed a header and this invention for the adhesive property to a substrate being improved by using what has the polymerization unit of specific structure as resin which constitutes the positive-resist constituent of a chemistry magnification mold.

[0007]

[Means for Solving the Problem] That is, this invention offers resin including both the polymerization unit of the acrylic ester system which has 2-alkyl-2-adamantyl as a \*\*\*\*\* machine (meta), and the polymerization unit drawn from itaconic acid anhydride, and the chemistry magnification mold positive-resist constituent which comes to contain an acid generator.

[0008] Here, the polymerization unit which the polymerization unit of the acrylic ester system which has 2-alkyl-2-adamantyl as a \*\*\*\*\* machine (meta) means the unit of the 2-alkyl-2-adamantyl (meta) acrylate origin shown by the bottom formula (I), and is drawn from itaconic acid anhydride means the unit shown by the bottom formula (II).

[0009]



[0010] The inside of a formula, and R1 Hydrogen or methyl is expressed and it is R2. The alkyl of carbon numbers 1-4 is expressed.

[0011]

[Embodiment of the Invention] The resin which has the polymerization unit of the above-mentioned formula (I) is publication number. The resin which is indicated by 9 No. -73173 official report, and has the polymerization unit of the above-mentioned formula (II) is publication number. 7-234511

Although indicated by the number official report, dry etching resistance, resolution, and an adhesive improvement are achieved by combining these two polymerization units. R2 in a formula (I) You may

branch, although it is the alkyl of carbon numbers 1-4 and it is usually advantageous that it is a straight chain as for this alkyl. Specifically, methyl, ethyl, n-propyl, isopropyl, n-butyl, etc. are mentioned. Resin including each polymerization unit of a formula (I) and a formula (II) can manufacture acrylic-acid (meta) 2-alkyl-2-adamanthyl and a maleic anhydride by [ respectively indispensable ] performing copolymerization as a configuration monomer.

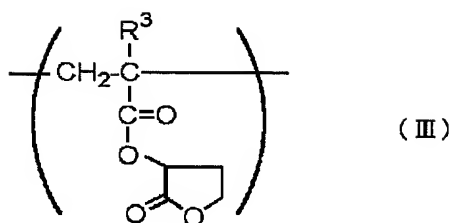
[0012] Moreover, this resin may include polymerization units other than a formula (I) and a formula (II). Other polymerization units which may be contained in arbitration do not have a ring, but are desirable. [ of the thing which has cyclic structures, such as an alicyclic ring, lactone residue and cyclic anhydride residue other than a formula (II), ] As for especially an alicyclic ring, it is desirable that alicyclic hydrocarbon residue and it are also bridge formation hydrocarbon rings, for example, a bornane ring, a norbornane ring, a tricyclodecane ring, a tetracyclo dodecane ring, an adamantane ring, etc. are mentioned. The polymerization unit more specifically drawn from the vinyl ester or isopropenyl ester of the polymerization unit and alicyclic carboxylic acid which are led from the alicyclic ester of an acrylic acid (meta) can be mentioned. Furthermore, the carboxylic-acid radical and alcoholic hydroxyl group of isolation can also be contained partially.

[0013] Especially the thing made to contain butyrolactone residue in resin especially is desirable from an adhesive viewpoint. Even if butyrolactone residue here did not permute, you may permute by alkyl and this alkyl can be about one to four carbon number like methyl, ethyl, propyl, and butyl. This butyrolactone residue is combinable with a resin matrix in the form of an ester bond or ether linkage. Although especially the location of the joint hand in butyrolactone residue is not limited, the joint hand has come out from alpha-grade (namely, 2-grades) of a butyrolactone, for example. a form [ like the ester of an acrylic acid or a methacrylic acid ] such whose butyrolactone residue is -- it is -- the principal chain of resin -- a direct rope -- \*\*\*\* -- you may be -- an alicyclic ring -- butyrolactone residue -- an ester bond -- or ether linkage may be carried out and an ester bond or a form which carries out ether linkage is sufficient as the alicyclic ring at the principal chain of resin.

[0014] Although the approach of generally copolymerizing the monomer which has butyrolactone residue with aforementioned 2-alkyl-2-adamanthyl methacrylate and itaconic acid anhydride is adopted in order to introduce butyrolactone residue into resin, the approach of making butyrolactone ester the resin which has a carboxylic-acid radical and an alcoholic hydroxyl group, or using it as the butyrolactone ether can also be adopted. The halogenation object of the butyrolactone which may be permuted by alkyl can be used for esterification and etherification for introducing butyrolactone residue into a monomer or resin. As a monomer which has butyrolactone residue, they are alpha-AKURIRO yloxy-gamma-butyrolactone, alpha-meta-KURIRO yloxy-gamma-butyrolactone, and alpha-AKURIRO yloxy, for example. - beta and beta-dimethyl-gamma-butyrolactone etc. is mentioned.

[0015] Typically as a polymerization unit which has butyrolactone residue, it is a bottom type (III). What is shown can be mentioned.

[0016]



[0017] The inside of a formula, and R3 Hydrogen or methyl is expressed.

[0018] Moreover, generally by the resin insoluble to alkali in itself which some radicals \*\*\*\* according to an operation of an acid, and after \*\*\*\* serves as alkali fusibility, and is used for this invention although it carries out [ are and ] and is refractory, the 2-alkyl-2-adamantyl radical in said formula (I) \*\*\*\* the resin for chemistry magnification mold positives resist according to an operation of an acid. Therefore, although the resist constituent which contains this resin by having the polymerization unit of a formula (I) acts on a positive type, other polymerization units which have the radical which \*\*\*\* according to an operation of an acid may be included if needed.

[0019] As other radicals which \*\*\*\* according to an operation of an acid, specifically The various ester of a carboxylic acid, for example, with a carbon number of about one to six represented by tert-butyl ester alkyl ester, Methoxymethyl ester, ethoxy methyl ester, 1-ethoxyethyl ester, 1-isobutoxy ethyl ester, 1-isopropoxy ethyl ester, 1-ethoxy propyl ester, 1-(2-methoxyethoxy) ethyl ester, 1-(2-acetoxyethoxy)ethyl ester, 1-[2-(1-adamantyloxy) ethoxy] ethyl ester, Alicyclic ester like 1-[2-(1-adamantane carbonyloxy) ethoxy] ethyl ester, tetrahydro-2-furanyl ester, acetal mold ester like tetrahydro-2-pyranyl ester, and isobornyl ester etc. is mentioned. The monomer for leading to the polymerization unit which has such carboxylate An acrylic thing like methacrylic ester or acrylic ester may be used, and like norbornene carboxylate, tricyclo decene carboxylate, and tetracyclo decene carboxylate What the carboxylate radical combined with the alicyclic monomer may be used. Further Iwasa et al, Journal of Photopolymer Scienceand Technology, Vol.9, and No.3 (1996) 447-456 As [ indicate ] The thing in which an acrylic acid or a methacrylic acid, and ester were formed is sufficient as the alicyclic radical of alicyclic carboxylate.

[0020] Although the resin used by this invention is changed according to the class of other polymerization units included in the class and arbitration of a radiation for patterning exposure etc., it is desirable to contain the polymerization unit shown by the formula (I) and the formula (II) in [ 20 - 70 mol ] % generally, respectively, and the polymerization unit which has butyrolactone residue may be contained in not more than 70 mol %. Furthermore, when it includes the polymerization unit which has the radical which \*\*\*\* according to the operation of an acid of those other than the polymerization unit shown by the formula (I), the amount has desirable less than [ 50 mol % ] extent. the polymerization unit which has an alicyclic ring although it is not necessary to establish the polymerization unit which has an alicyclic ring apart from it since this resin has an alicyclic ring in the polymerization unit of a formula (I) -- the whole -- more than 20 mol % -- existing is desirable.

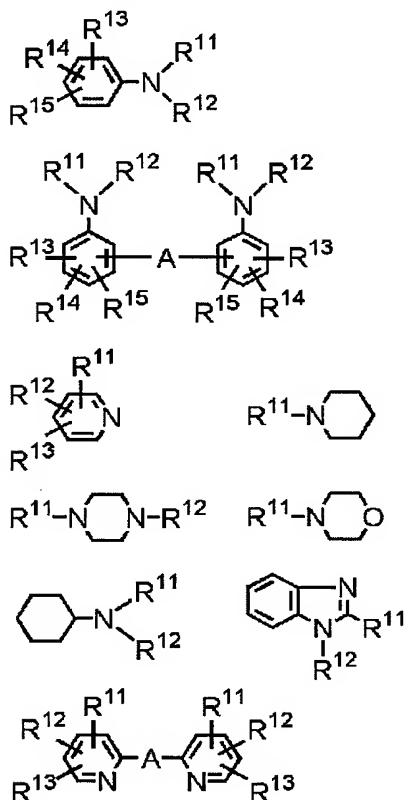
[0021] By making radiations, such as light and an electron ray, act on the matter itself or the resist constituent containing the matter, the matter decomposes and the acid generator which is another component generates an acid. The acid generated from an acid generator acts on said resin, and it is

also made \*\*\*\*(ed) when other radicals which \*\*\*\* the 2-alkyl-2-adamantyl in a formula (I) in an operation of an acid again exist. For example, an onium salt compound, an organic halogenated compound, a sulfone compound, a sulfonate compound, etc. are included by such acid generator. Specifically, the following compounds can be mentioned.

[0022] Diphenyliodonium Trifluoromethane sulfonate, 4-methoxyphenyl phenyliodonium Hexafluoroantimonate, 4-methoxyphenyl phenyliodonium Trifluoromethane sulfonate, Bis(4-tert-buthylphenyl) iodonium Tetrafluoroborate, Bis(4-tert-buthylphenyl) iodonium Hexafluorophosphate, Bis(4-tert-buthylphenyl) iodonium Hexafluoroantimonate, bis(4-tert-buthylphenyl) iodonium trifluoromethane sulfonate, [0023] Triphenylsulfonium Hexafluorophosphate, triphenylsulfonium Hexafluoroantimonate, Triphenylsulfonium Trifluoromethane sulfonate, 4-methoxyphenyl diphenyl sulfonium Hexafluoroantimonate, 4-methoxyphenyl diphenyl sulfonium Trifluoromethane sulfonate, 4-methylphenyl diphenyl sulfonium Trifluoromethane sulfonate, 2, 4, 6-trimethyl phenyl diphenyl sulfonium Trifluoromethane sulfonate, 4-tert-buthylphenyl diphenyl sulfonium Trifluoromethane sulfonate, 4-phenylthiophenyl diphenyl sulfonium Hexafluorophosphate, 4-phenylthiophenyl diphenyl sulfonium Hexafluoroantimonate, 1-(2-naphthylmethyl)thiolanium Hexafluoroantimonate, 1-(2-naphthylmethyl)thiolanium Trifluoromethane sulfonate, 4-hydroxy-1-naphthyl dimethyl sulfonium Hexafluoroantimonate, 4-hydroxy-1-naphthyl dimethyl sulfonium Trifluoromethane sulfonate, [0024] The 2-methyl -4, 6-bis(TORIKURORO methyl)-1,3,5-triazine, 2, 4, 6-tris (TORIKURORO methyl)-1,3,5-triazine, The 2-phenyl -4, 6-bis(TORIKURORO methyl)-1,3,5-triazine, 2-(4-chlorophenyl)-4, 6-bis(TORIKURORO methyl)-1,3,5-triazine, 2-(4-methoxyphenyl)-4, 6-bis(TORIKURORO methyl)-1,3,5-triazine, 2-(4-methoxy-1-naphthyl)-4, 6-bis(TORIKURORO methyl)-1,3,5-triazine, 2-([Benzod] [1, 3] dioxolane-5-IRU)-4, 6-bis(TORIKURORO methyl)-1,3,5-triazine, 2-(4-methoxy styryl)-4, 6-bis(TORIKURORO methyl)-1,3,5-triazine, 2-(3, 4, 5-trimethoxy styryl)-4, 6-bis(TORIKURORO methyl)-1,3,5-triazine, 2-(3, 4-dimethoxy styryl)-4, 6-bis(TORIKURORO methyl)-1,3,5-triazine, 2-(2, 4-dimethoxy styryl)-4, 6-bis(TORIKURORO methyl)-1,3,5-triazine, 2-(2-methoxy styryl)-4, 6-bis(TORIKURORO methyl)-1,3,5-triazine, 2-(4-butoxy styryl)-4, 6-bis(TORIKURORO methyl)-1,3,5-triazine, 2-(4-pentyloxy styryl)-4, 6-bis(TORIKURORO methyl)-1,3,5-triazine, [0025] 1-benzoyl-1-phenylmethyl P-toluene sulfonate (common-name benzoin tosylate), 2-benzoyl-2-hydroxy-2-phenylethyl P-toluene sulfonate (common-name alpha-methylol benzoin tosylate), 1 and 2, 3-benzene Trier Tris methanesulfonate, 2, 6-dinitro benzyl P-toluene sulfonate, 2-nitrobenzyl P-toluene sulfonate, 4-nitrobenzyl P-toluene sulfonate, [0026] Diphenyl Disulfon, G p-tolyl Disulfon, bis(phenyl sulfonyl) diazomethane, bis(4-chlorophenyl sulfonyl) diazomethane, bis(p-tolyl sulfonyl) diazomethane, bis(4-tert-buthylphenyl sulfonyl) diazomethane, bis(2, 4-xylyl sulfonyl) diazomethane, bis(cyclohexyl sulfonyl) diazomethane, diazomethane (phenyl (benzoyl) sulfonyl), [0027] N-(phenylsulfonyloxy)succinimide, N-(trifluoromethyl sulfonyloxy)succinimide, N-(trifluoromethyl sulfonyloxy)phthalimide, N-(trifluoromethyl sulfonyloxy)-5-norbornene -2, 3-dicarboxyimide, N-(trifluoromethyl sulfonyloxy)naphthalimide, N-(10-camphor sulfonyloxy) North America Free Trade Agreement RUIMIDO, etc.

[0028] Moreover, it is known that the performance degradation by deactivation of the acid generally accompanied by the basic compound, especially the basic nitrogen-containing organic compound, for example, amines, every length after exposure by adding as a quencher in the positive-resist constituent of a chemistry magnification mold will be improvable, and it is desirable also in this invention to blend such a basic compound. As a concrete example of the basic compound used for a quencher, a thing as shown by each following formula is mentioned.

[0029]



[0030] R11, R12, R13, R14, and R15 express among a formula hydrogen, the alkyl which may be permuted with a hydroxyl group, cycloalkyl, aryl, or ARUKOKISHI mutually-independent, and A expresses alkylene, carbonyl, or IMINO. It can be the alkyl and alkoxy \*\* which are expressed with R11-R15, and about one to six carbon number here, and cycloalkyl can be about five to ten carbon number, and aryl can be about six to ten carbon number. Moreover, the alkylene expressed with A can be about one to six carbon number, and may branch also with the straight chain.

[0031] As for the resist constituent of this invention, it is desirable that contain resin at 80 – 99.9 % of the weight, and it contains an acid generator in 0.1 – 20% of the weight of the range on the basis of the total-solids weight. Moreover, when using the basic compound as a quencher, similarly it is desirable to contain in 0.0001 – 0.1% of the weight of the range on the basis of the total-solids weight of a resist constituent. This constituent can also carry out little content of various kinds of additives, such as a sensitizer, a dissolution retardant, other resin, a surfactant, a stabilizer, and a color, again if needed.

[0032] Each above-mentioned component usually serves as resist liquid in the condition of having



dissolved in the solvent, and the resist constituent of this invention is applied on bases, such as a silicon wafer. The solvent used here dissolves each component, has a suitable rate of drying, and after a solvent evaporates, it can usually be used in this field that what is necessary is just what gives a uniform and smooth paint film. For example, the ester like the glycol ether ester like ethylcellosolve acetate, methyl-cellosolve acetate, and propylene-glycol-monomethyl-ether acetate, ethyl lactate, butyl acetate, amyl acetate, and pyruvic-acid ethyl, an acetone, methyl isobutyl ketone, 2-heptanone and the ketones like a cyclohexanone, and the cyclic ester like gamma-butyrolactone can be mentioned. These solvents are independent, respectively, or can be combined two or more sorts and can be used. The result of having been excellent in spreading nature and having excelled also in resolution especially when the solvent whole [ for example, ] used 2-heptanone 50% of the weight or more as some solvents [ at least ] is obtained.

[0033] It is applied on a base, and exposure processing for patterning is performed, and after performing heat-treatment for subsequently promoting a deprotection radical reaction, negatives are developed by the dried resist film with an alkali developer. Although the alkali developers used here can be various kinds of alkaline water solutions used in this field, generally the water solution of tetramethylammonium hydroxide or trimethylammonium (2-hydroxyethyl) hydroxide (common-name choline) is used in many cases.

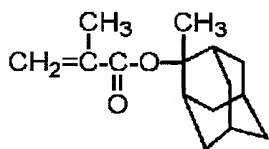
[0034]

[Example] Next, although an example is given and this invention is explained still more concretely, this invention is not limited at all by these examples. The section in an example is weight criteria as long as there is no special mention.

[0035] The synthetic example 1 (composition of a monomer)

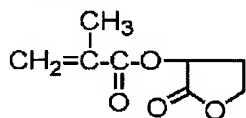
2-methyl-2-ADAMANTA Norian 83.1g and triethylamine 101g were taught, 200g methyl isobutyl ketone was added, and it considered as the solution. Methacrylic-acid chloride 78.4g (it is 1.5-mol twice to 2-methyl-2-ADAMANTA Norian) was dropped there, and it stirred at the room temperature after that for about 10 hours. The sodium bicarbonate water solution washed the organic layer 5% of the weight after filtration, and it rinsed twice continuously. After condensing an organic layer, vacuum distillation was carried out and the methacrylic-acid 2-methyl-2-adamantyl shown by the degree type was obtained at 75% of yield.

[0036]



alpha-BUROMO-gamma-butyrolactone) was dropped there, and it stirred at the room temperature after that for about 10 hours. The sodium bicarbonate water solution washed the organic layer 5% of the weight after filtration, and it rinsed twice continuously. The organic layer was condensed and the alpha-meta-KURIRO yloxy-gamma-butyrolactone shown by the degree type was obtained at 85% of yield.

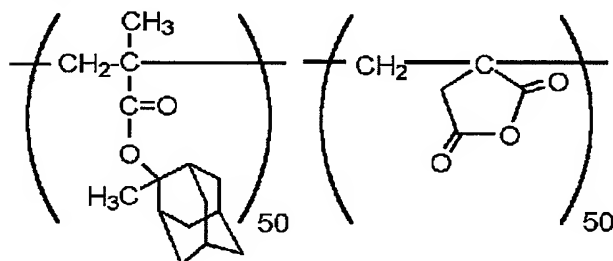
[0038]



[0039] The synthetic example 3 (composition of resin A1)

The methacrylic-acid 2-methyl-2-adamantyl and itaconic acid anhydride which were obtained in the synthetic example 1 were taught by the mole ratio (20.0g : 9.6g) of 50:50, twice [ 2 weight ] as many methyl isobutyl ketone as all monomers was added, and it considered as the solution. there -- as an initiator -- azobisisobutyronitril -- the total amount of monomers -- receiving -- one-mol % -- it added and heated at 90 degrees C for about 8 hours. Then, actuation of having filled a lot of heptanes with reaction mixture, and settling it was performed twice, and was refined. Consequently, it is shown by the degree type and, for the presentation mole ratio of each unit, weight average molecular weight is abbreviation at 50:50. The copolymer of 8,000 was obtained.

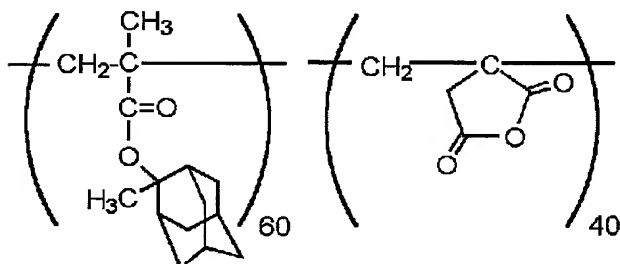
[0040]



[0041] The synthetic example 4 (composition of resin A2)

The same actuation as the synthetic example 3 was performed except having taught methacrylic-acid 2-methyl-2-adamantyl and itaconic acid anhydride by the mole ratio (20.0g : 6.4g) of 60:40. Consequently, it is shown by the degree type and, for the presentation mole ratio of each unit, weight average molecular weight is abbreviation at 60:40. The copolymer of 8,000 was obtained.

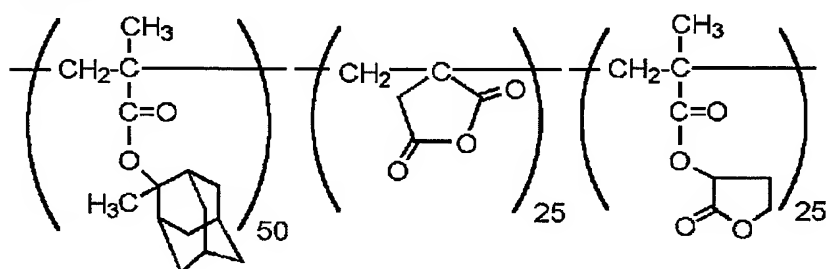
[0042]



## [0043] The synthetic example 5 (composition of resin A3)

The alpha-meta-KURIRO yloxy-gamma-butyrolactone and itaconic acid anhydride which were obtained in the methacrylic-acid 2-methyl-2-adamantyl obtained in the synthetic example 1 and the synthetic example 2 were taught by the mole ratio (20.0g : 7.3g : 4.8g) of 50:25:25, twice [ 2 weight ] as many methyl isobutyl ketone as all monomers was added, and it considered as the solution. there -- as an initiator -- azobisisobutyronitril -- the total amount of monomers -- receiving -- one-mol % -- it added and heated at 90 degrees C for about 8 hours. Then, actuation of having filled a lot of heptanes with reaction mixture, and settling it was performed twice, and was refined. Consequently, it is shown by the degree type and, for the presentation mole ratio of each unit, weight average molecular weight is abbreviation at 50:25:25. The copolymer of 8,000 was obtained.

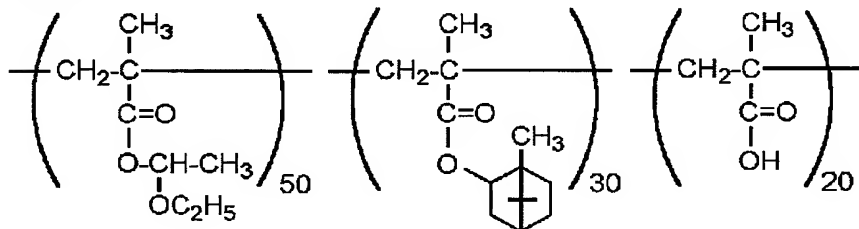
## [0044]



## [0045] The synthetic example 6 (composition of Resin AX: for a comparison)

Methacrylic-acid 1-ethoxyethyl, methacrylic-acid isobornyl, and a methacrylic acid were prepared by the mole ratio (31.6g : 26.7g : 6.9g) of 5:3:2, twice [ 2 weight ] as many methyl isobutyl ketone as all monomers was added, and it considered as the solution. there -- as an initiator -- azobisisobutyronitril -- the total amount of monomers -- receiving -- two-mol % -- it added and heated at 80 degrees C for about 8 hours. Then, actuation of having filled a lot of heptanes with reaction mixture, and settling it was performed twice, and was refined. Consequently, it is shown by the degree type and, for the presentation mole ratio of each unit, weight average molecular weight is abbreviation at 50:30:20. 10,000 The copolymer was obtained.

## [0046]



[0047] It is 4-methylphenyl diphenyl sulfonium considering the resin shown in Table 1 as the ten sections and an acid generator for every example 1-4 and example 1 of a comparison - 2 each example. It melted in the solvent 60 section which shows 2 and 6-diisopropyl aniline to 0.015 \*\*\*\*\*, and shows these in Table 1 by making trifluoromethane sulfonate (product made from Green Chemistry) into the 0.20 sections and a quencher, it filtered with the filter made of a fluororesin of

0.2 micrometers of apertures further, and resist liquid was prepared. It applied to the silicon wafer which applied the silicon wafer (60 degrees of contact angles of water) or the organic antireflection film which processed this by hexamethyldisilazane (HMDS) so that the thickness after desiccation might be set to 0.455 micrometers. The organic antireflection film is "DUV-18L" of Brewer. It was made to apply and form so that 215 degrees C and the baking conditions for 60 seconds may make thickness of 570A. The prebaking after resist liquid spreading is 120 degrees C and the conditions for 60 seconds, and was performed on the direct hot plate.

[0048] In this way, the KrF excimer stepper ["NSR 2205 EX12B" by NIKON CORP., NA=0.55] was used for the wafer in which the resist film was formed, and Rhine and a tooth-space pattern were exposed. Next, postexposure jar BEKU (PEB) was performed on 120 degrees C and the conditions for 60 seconds on the hot plate. Next, the developer which diluted a tetramethylammonium hydroxide water solution or it with ultrapure water 2.38% of the weight as shown in Table 1 performed paddle development for 60 seconds. The pattern after development was observed with the scanning electron microscope, and sensibility and resolution were investigated by the following approaches about the pattern obtained from the resist film prepared on the organic antireflection-film substrate.

[0049] Sensibility: It displayed with the light exposure (effective sensibility) from which 0.3-micrometer Rhine and a tooth-space pattern are set to 1:1.

[0050] Resolution: It displayed with the lower limit of Rhine separated with the light exposure of effective sensibility, and a tooth-space pattern.

[0051] Moreover, performed adhesive evaluation, what is pasted up on the substrate with the light exposure from which 0.3-micrometer Rhine and a tooth-space pattern are set to 1:1 about the pattern on the substrate which does not prepare an organic antireflection film was displayed as O, and what has separated was displayed as x. It is shown in Table 1 with the above resin and solvent using a result.

[0052]

[Table 1]

Example No.	Resin	Solvent	* Developer	Effective sensibility
Resolution	Adhesive property			
Example 1	A1	PGMEA	With no dilution	25 mJ/cm <sup>2</sup> 0.21 micrometers O
** 2	A1	MAK	With no dilution	35 mJ/cm <sup>2</sup> 0.18 micrometers O
** 3	A2	** With no dilution	35 mJ/cm <sup>2</sup> 0.18 micrometers O	** 4
A3	PGMEA	With no dilution	25 mJ/cm <sup>2</sup> 0.19 micrometers O	Example 1 of a comparison
AX	PGMEA	1/20 dilution	40 mJ/cm <sup>2</sup> 0.23 micrometers O	** 2
AX	** One fifth Dilution	35 mJ/cm <sup>2</sup> 0.25micrometer x		[0053] (Footnote of Table 1) * Solvent
PGMEA : Propylene-glycol-monomethyl-ether acetate MAK : 2-heptanone (alias name methyl amyl ketone)				

[0054] Even if developer concentration is high, the resist using resin A1 and A2 or A3 does not cause development peeling, and is excellent in the adhesive property over a substrate with this invention, as shown in Table 1. Moreover, resolution is also improved and sensibility is not spoiled. The constituent used in the examples 1-4 gives the resist pattern of the engine performance which

was excellent in exposure by the ArF excimer laser exposure machine similarly.

[0055]

[Effect of the Invention] The chemistry magnification mold positive-resist constituent of this invention is excellent in the adhesive property to a substrate, and many resist engine performance, such as sensibility and resolution, is also good. Therefore, this constituent fits the exposure which used the KrF excimer laser, the ArF excimer laser, etc., and gives the resist pattern of the high engine performance by it.

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[Translation done.]